What is claimed is:

1. A photoresist composition comprising a photoactive component and a polymer that comprises: i) a heteroalicyclic group fused to the polymer backbone and that contains one or more oxygen or sulfur ring members; ii) a carbon alicyclic group fused to the polymer backbone; and iii) a photoacid-labile moiety.

2. The photoresist of claim 1 wherein the heteroalicyclic group has an oxygen ring member.

3. The photoresist of claim 1 wherein the heteroalicyclic group has a sulfur ring member.

4. The photoresist of any one of claims 1 through 3 wherein the carbon alicyclic group is a polymerized norbornene group.

5. The photoresist of any one of claims 1 through 4 wherein the heteroalicyclic group has a non-hydrogen ring substituent.

6. The photoresist of any one of claims 1 through 5 wherein the photoacid-labile moiety is a substituent of the heteroalicyclic group and/or the carbon alicyclic group.

7. The photoresist of any one of claims 1 through 6 wherein the photoacid-labile moiety is a polymer unit separate from the heteroalicyclic group or the carbon alicyclic group.

8. The photoresist of claim 7 wherein the polymer comprises a polymerized acrylate that comprises a photoacid-labile moiety.

9. The photoresist of any one of claims 1 through 8 wherein the polymer further comprises lactone and/or anhydride units.

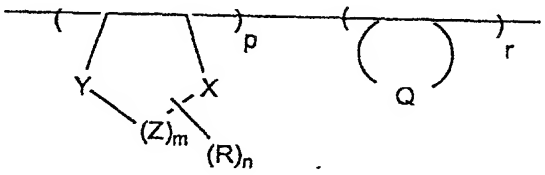
10. The photoresist of any one of claims 1 through 9 wherein the polymer further comprises maleic anhydride units.

11. The photoresist of any one of claims 1 through 10 wherein the heteroalicyclic group fused to the polymer backbone does not contain an unsaturated oxygen.

12. The photoresist of any one of claims 1 through 11 wherein the heteroalicyclic group fused to the polymer backbone does not contain an unsaturated sulfur.

13. The photoresist of any one of claims 1 through 11 wherein the heteroalicyclic group fused to the polymer backbone is not an anhydride or lactone.

14. The photoresist of claim 1 wherein the polymer comprises a structure of the following Formula I:



I

wherein X, Y, and each Z are each independently carbon or oxygen, with at least one of X, Y or Z being oxygen;

Q represents an optionally substituted carbon alicyclic ring with two ring members being adjacent carbons of the polymer backbone;

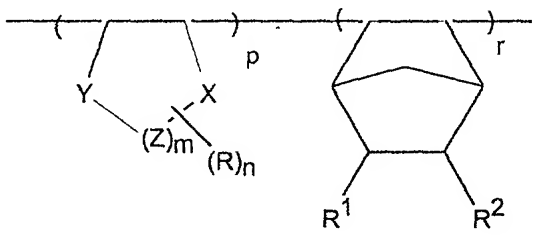
each R is the same or different non-hydrogen substituent;

m is 1, 2, 3 or 4;

n is an integer of from 0 to the maximum value permitted by the valences of the ring members;

p is the mole fraction of the fused oxygen ring units based on total units in the polymer; and r is the mole fraction of the fused carbon alicyclic ring units based on total units in the polymer, and p and r are each greater than zero.

15. The photoresist of claim 1 wherein the polymer comprises a structure of the following Formula IA:



IA

wherein X, Y, and each Z are each independently carbon or oxygen, with at least one of X, Y or Z being oxygen;

each R is the same or different non-hydrogen substituent;

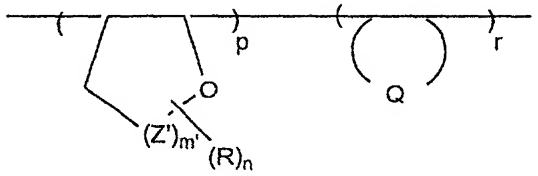
m is 1, 2, 3 or 4;

n is an integer of from 0 to the maximum value permitted by the valences of the ring members;

R^1 and R^2 are each independently hydrogen or a non-hydrogen substituent;

p is the mole fraction of the fused oxygen ring units based on total units in the polymer; and r is the mole fraction of the fused optionally substituted norbornene ring units based on total units in the polymer, and p and r are each greater than zero.

16. The photoresist of claim 1 wherein the polymer comprises a structure of the following Formula IB:



IB

wherein Z' is oxygen, sulfur or carbon; m' is 1, 2, 3 or 4;

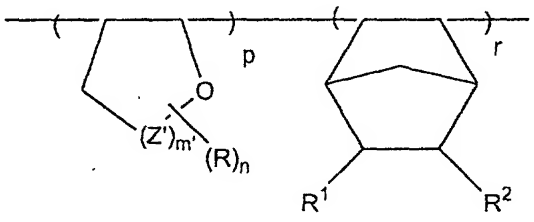
Q represents an optionally substituted carbon alicyclic ring with two ring members being adjacent carbons of the polymer backbone;

each R is the same or different non-hydrogen substituent;

n is an integer of from 0 to the maximum value permitted by the valences of the ring members;

p is the mole fraction of the fused oxygen ring units based on total units in the polymer; and r is the mole fraction of the fused carbon alicyclic ring units based on total units in the polymer, and p and r are each greater than zero.

17. The photoresist of claim 1 wherein the polymer comprises a structure of the following Formula IC:



IC

wherein Z' is oxygen, sulfur or carbon; m' is 1, 2, 3 or 4;

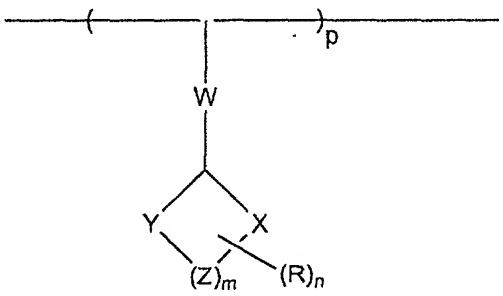
each R is the same or different non-hydrogen substituent;

n is an integer of from 0 to the maximum value substitution permitted by the valences of the ring members;

R^1 and R^2 are each independently hydrogen or a non-hydrogen substituent;

p is the mole fraction of the fused oxygen ring units based on total units in the polymer; and r is the mole fraction of the fused carbon alicyclic ring units based on total units in the polymer, and p and r are each greater than zero.

18. The photoresist of claim 1 wherein the polymer comprises units of the following Formula III:



III

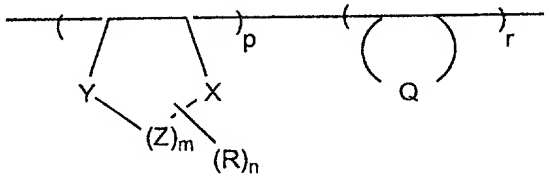
wherein W is a linker;

wherein X, Y, and each Z are each independently carbon, oxygen, or sulfur, with at least one of X, Y or Z being oxygen or sulfur;

each R is the same or different non-hydrogen substituent;

m is 1, 2, 3, 4 or 5; n is an integer of from 0 to the maximum value substitution permitted by the valences of the ring members; and p is the mole percent of the units in the polymer.

19. The photoresist of claim 1 wherein the polymer comprises a structure of the following Formula IV:



IV

wherein X, Y, and each Z are each independently carbon or sulfur, with at least one of X, Y or Z being sulfur;

Q represents an optionally substituted carbon alicyclic ring with two ring members being adjacent carbons of the polymer backbone;

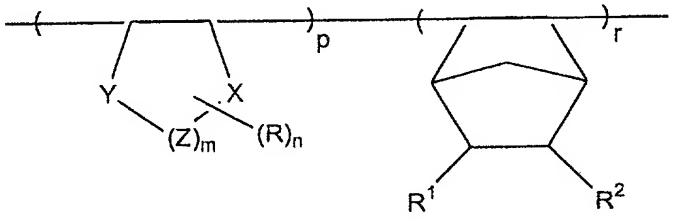
each R is the same or different non-hydrogen substituent;

m is 1, 2 or 3;

n is an integer of from 0 to the maximum value permitted by the valences of the ring members;

p is the mole fraction of the fused oxygen ring units based on total units in the polymer; and r is the mole fraction of the fused carbon alicyclic ring units based on total units in the polymer, and p and r are each greater than zero.

20. The photoresist of claim 1 wherein the polymer comprises a structure of the following Formula IVA:



IVA

wherein X, Y, and each Z are each independently carbon, oxygen, or sulfur, with at least one of X, Y or Z being sulfur;

each R is the same or different non-hydrogen substituent;

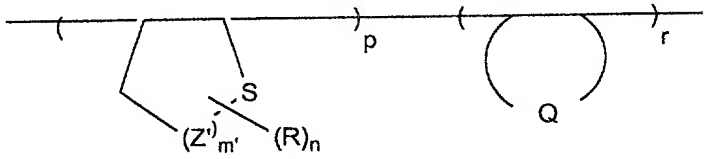
m is 1, 2 or 3;

n is an integer of from 0 to the maximum value permitted by the valences of the ring members;

R^1 and R^2 are each independently hydrogen or a non-hydrogen substituent;

p is the mole fraction of the fused oxygen ring units based on total units in the polymer; and r is the mole fraction of the fused optionally substituted norbornene ring units based on total units in the polymer, and p and r are each greater than zero.

21. The photoresist of claim 1 wherein the polymer comprises a structure of the following Formula IVB:



IVB

wherein each Z' is oxygen, sulfur or carbon; m' is 1, 2, 3 or 4;

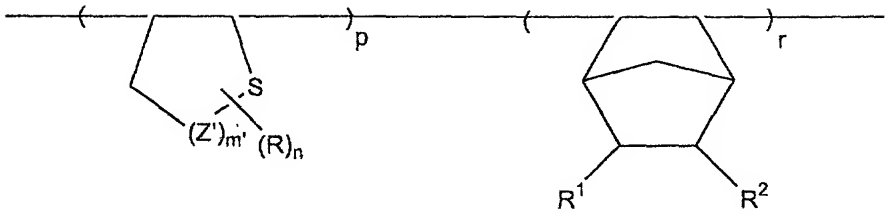
Q represents an optionally substituted carbon alicyclic ring with two ring members being adjacent carbons of the polymer backbone;

each R is the same or different non-hydrogen substituent;

n is an integer of from 0 to the maximum value permitted by the valences of the ring members;

p is the mole fraction of the fused oxygen ring units based on total units in the polymer; and r is the mole fraction of the fused carbon alicyclic ring units based on total units in the polymer, and p and r are each greater than zero.

22. The photoresist of claim 1 wherein the polymer comprises a structure of the following Formula IVC:



IVC

wherein Z' is oxygen, sulfur or carbon; m' is 1, 2, 3 or 4;

each R is the same or different non-hydrogen substituent;

n is an integer of from 0 to the maximum value substitution permitted by the valences of the ring members;

R^1 and R^2 are each independently hydrogen or a non-hydrogen substituent;

p is the mole fraction of the fused oxygen ring units based on total units in the polymer; and r is the mole fraction of the fused carbon alicyclic ring units based on total units in the polymer, and p and r are each greater than zero.

23. The photoresist of any one of claims 1 through 22 wherein the polymer is a tetrapolymer or a pentapolymer.

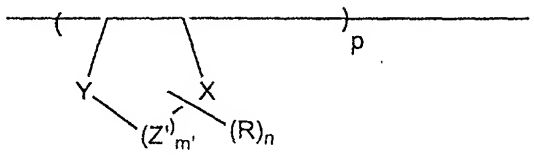
24. The photoresist of any one of claims 1 through 23 wherein the polymer is completely free of aromatic groups.

25. A photoresist composition comprising a photoactive component and a polymer that comprises i) a heteroalicyclic group that contains one or more sulfur ring members; and ii) a photoacid-labile moiety.

26. The photoresist of claim 25 wherein the photoacid-labile moiety is a polymer unit separate from the heteroalicyclic group.

27. The photoresist of claim 25 wherein the polymer comprises a polymerized acrylate that comprises a photoacid-labile moiety.

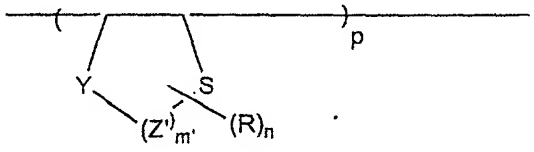
28. The photoresist of claim 25 wherein the polymer contains units of the following Formula II:



II

wherein X, Y, and each Z are each independently carbon, oxygen or sulfur, with at least one of X, Y or Z being sulfur; each R is the same or different non-hydrogen substituent; m is 1, 2, 3 or 4; n is an integer of 0 to the maximum value permitted by the valences of the ring members; and p is greater than zero and is the mole percent of the units in the polymer.

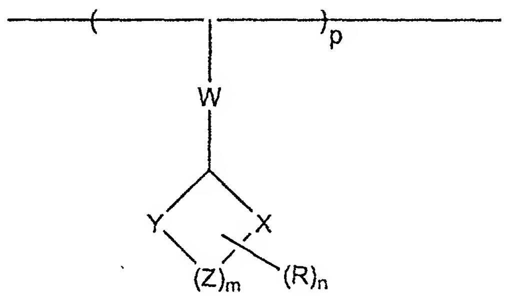
29. The photoresist of claim 25 wherein the polymer contains units of the following Formula IIA:



IIA

wherein Y and Z' are each independently carbon, oxygen or sulfur; m' is 1, 2, 3 or 4; each R is the same or different non-hydrogen substituent; n is an integer of 0 to the maximum value permitted by the valences of the ring members; and p is greater than zero and is the mole percent of the units in the polymer.

30. The photoresist of claim 25 wherein the polymer comprises units of the following Formula III:



III

wherein W is a linker;

wherein X, Y, and each Z are each independently carbon, oxygen, or sulfur, with at least one of X, Y or Z being oxygen or sulfur;

each R is the same or different non-hydrogen substituent;

m is 1, 2, 3, 4 or 5; n is an integer of from 0 to the maximum value substitution permitted by the valences of the ring members; and p is greater than zero and is the mole percent of the units in the polymer.

31. The photoresist of any one of claims 25 through 30 wherein the polymer further comprises one or more units selected from the group consisting of carbon alicyclic, lactone, and anhydride.

32. The photoresist of any one of claims 25 through 31 wherein the polymer comprises norbornene units.

33. The photoresist of any one of claims 25 through 32 wherein the polymer is a tetrapolymer or a pentapolymer.

34. The photoresist of any one of claims 25 through 33 wherein the polymer is completely free of aromatic groups.

35. A method of forming a positive photoresist relief image, comprising:

(a) applying a coating layer of a photoresist of any one of claims 1 through 24 on a substrate; and

(b) exposing and developing the photoresist layer to yield a relief image.

36. The method of claim 35 wherein the photoresist layer is exposed with radiation having a wavelength of less than about 200 nm.

37. The method of claim 35 wherein the photoresist layer is exposed with radiation having a wavelength of about 193 nm.

38. A method of forming a positive photoresist relief image, comprising:

(a) applying a coating layer of a photoresist of any one of claims 25 through 34 on a substrate; and

(b) exposing and developing the photoresist layer to yield a relief image.

39. The method of claim 38 wherein the photoresist layer is exposed with radiation having a wavelength of less than about 200 nm.

40. The method of claim 38 wherein the photoresist layer is exposed with radiation having a wavelength of about 193 nm.

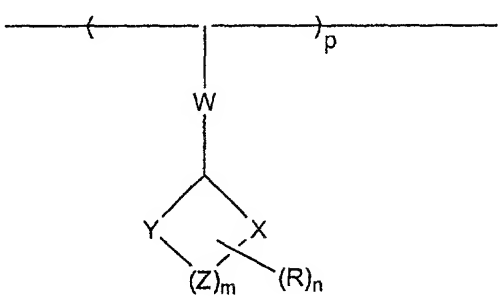
41. An article of manufacture comprising a microelectronic wafer substrate or flat panel display substrate having coated thereon a layer of the photoresist composition of any one of claims 1 through 24.

42. An article of manufacture comprising a microelectronic wafer substrate or flat panel display substrate having coated thereon a layer of the photoresist composition of any one of claims 25 through 34.

43. A polymer that comprises: i) a heteroalicyclic group fused to the polymer backbone and that contains one or more oxygen or sulfur ring members; ii) a carbon alicyclic group fused to the polymer backbone; and iii) a photoacid-labile moiety.

44. A polymer that comprises: i) a heteroalicyclic group that contains one or more sulfur ring members; and ii) a photoacid-labile group.

45. A polymer that comprises units of the following Formula III:



III

wherein W is a linker;

wherein X, Y, and each Z are each independently carbon, oxygen, or sulfur, with at least one of X, Y or Z being oxygen or sulfur;

each R is the same or different non-hydrogen substituent;

m is 1, 2, 4 or 5; n is an integer of from 0 to the maximum value substitution permitted by the valences of the ring members; and p is the mole percent of the units in the polymer.